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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

LOUIS R. BROTHERS, JR.

Serial No. 09/987,722 (TI-34299)

Filed November 15, 2001

For: METHOD AND APPARATUS FOR RECEIVED UPLINK SIGNAL BASED ADAPTIVE DOWNLINK DIVERSITY WITHIN A COMMUNICATION SYSTEM

Art Unit 2684

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10-11-05

Jay M. Cantor, Reg. No. 19,906

Sir:

BRIEF ON APPEAL

REAL PARTY IN INTEREST

The real party in interest is Texas Instruments Incorporated, a Delaware corporation with offices at 7839 Churchill Way, Dallas, Texas 75251.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals and/or interferences.

STATUS OF CLAIMS

This is an appeal of claims 1 to 13, 15 to 30, 32 to 50 and 52 to 56, all of the rejected claims. No claims have been allowed and claims 14, 31 and 51 have been canceled. Please note that the listing of claims on appeal in the Notice of Appeal is in error and that the above-noted claims are those on appeal since the Notice of Appeal clearly stated that the appeal was being taken as <u>to all of</u> the rejected claims. Please charge any costs to Deposit Account No. 20-0668.

STATUS OF AMENDMENTS

An amendment was filed after final rejection and entered for purposes of appeal.

SUMMARY OF CLAIMED SUBJECT MATTER

The performance gain of prior art wireless communication systems is disadvantageously dependent on the location of the user terminal, and on the spatial and temporal properties of the radio environment. Thus, a need exists for combining downlink diversity (DD) and spatial division multiple access (SDMA) more effectively to thereby overcome this dependency, while also substantially reducing multiple access interference (MAI) This is accomplished by determining a first downlink transmission beam and a second downlink transmission beam based on a received user-derived signal (two of 301-304). The first downlink transmission beam is substantially uncorrelated with the second downlink transmission beam. The first downlink transmission beam is associated with a portion within a first sector (a sector [0020] being defined as a portion of the mobile cell or directional antenna coverage from an otherwise omnidirectional antenna providing a 360° coverage). The second downlink transmission beam is associated with a portion within a second sector. A first signal is diversity encoded to produce a first diversity-

encoded signal. A second signal is diversity encoded to produce a second diversity-encoded signal. The first diversity-encoded signal is sent over the first downlink transmission beam. The second diversity-encoded signal is sent over the second downlink transmission beam. The first uplink multipath and the second uplink multipath are no less optimal than the remaining uplink multipaths from the plurality of uplink multipaths (paragraphs [0037], [0039-0046]).

GROUNDS OF REJECTION

Claims 1, 2, 3, 7 to 12, 14 to 19, 21, 22, 24 to 29, 31 to 33, 35 to 49, 51 to 54 and 56 were rejected under 35 U.S.C. 102(e) as being anticipated by Ylitalo et al. (U.S. 6,788,661

Claim 2 was rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. in view of Ionescu (U.S. 6,603,809).

Claims 5, 6, 13, 23 and 30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. in view of Dajer et al. (U.S. 6,539,209).

Claims 20, 34, 50 and 55 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. in view of Dajer and further in view of Thibault et al. (U.S. 6,240,098)

ARGUMENT

Claims 1, 2, 3, 7 to 12, 14 to 19, 21, 22, 24 to 29, 31 to 33, 35 to 49, 51 to 54 and 56 were rejected under 35 U.S.C. 102(e) as being anticipated by Ylitalo et al. (U.S. 6,788,661. The rejection is without merit.

Each of claims 1, 22 and 36, all of the independent claims from which the remaining claims depend, requires that the first downlink transmission beam be associated with a first uplink multipath/ from a plurality of uplink multipaths associated with a first user, the second

downlink transmission beam be associated with a second uplink multipath from the plurality of uplink multipaths, the first uplink multipath and the second uplink multipath being no less optimal than the remaining uplink multipaths from the plurality of uplink multipaths. No such feature is taught or suggested by Ylitalo et al. or any of the other applied references.

As stated in the paragraph bridging pages 8 and 10 of the specification, directed diversity transmission allows the exploitation of the long-term reciprocity of the multipath channel. For example, the beams that contain the strongest multipath components on the uplink can be used for downlink transmission. More specifically, the beam that contained the strongest multipath component on the uplink can be used on the downlink to carry a first diversity signal. The beam that contained the second strongest signal on the uplink can be used on the downlink to carry a second diversity signal. The first and second diversity signals can be generated by diversity coder 460. In one embodiment, the first and second diversity signals can be transmitted with the same power. In other embodiments, however, other power distributions are possible. For instance, it may be beneficial to match the transmit powers to the receive powers. In general, by transmitting two diversity signals using two orthogonally polarized beams, the user terminal is provided with at least two substantially uncorrelated signals.

Claims 3, 4, 7 to12, 14 to19, 21, 24 to 29, 31 to 33, 35, 37 to 49, 51 to 54 and 56 define patentably over Ylitalo et al. for at least the reasons presented above with reference to the claims from which they depend as well as reasons previously presented.

Claim 2 was rejected under 35 U.S.C.103(a) as being unpatentable over Ylitalo et al. in view of Ionescu (U.S. 6,603,809). The rejection is without merit.

Claim 2 depends from claim 1 and therefore defines patentably over the applied references since Ionescu does not overcome the deficiencies in Ylitalo et al. as previously noted hereinabove.

Claims 5, 6, 13, 23 and 30 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. in view of Dajer et al. (U.S. 6,539,209. The rejection is without merit.

Claims 5, 6 and 13 depend from claim 1 and claims 22 and 30 depend from claim 22 and accordingly define patentably over the applied references for at least the reasons presented above with reference to the claims from which they depend since Dajer et al. fails to overcome the deficiencies in Ylitalo et al. as demonstrated above.

Claims 20, 34, 50 and 56 were rejected under 35 U.S.C.103(a) as being unpatentable over Ylitalo et al. in view of Dajer et al. further in view of Thibault et al. (U.S. 6,240,096). The rejection is without merit.

Claim 20 depends from claim 1, claim 34 depends from claim 22 and claims 50 and 56 depend from claim 35 and accordingly define patentably over the applied references for at least the reasons presented above with reference to the claims from which they depend since both Dajer et al. and Thibault et al. fail to overcome the deficiencies in Ylitalo et al. as demonstrated above.

CONCLUSIONS

For the reasons stated above, reversal of the final rejection and allowance of the claims on appeal is requested that justice be done in the premises.

Respectfully submitted,

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CLAIMS APPENDIX

The claims on appeal read as follows:

1. A method for wireless communication, comprising the steps of

determining sectors of a cell;:

determining a first downlink transmission beam and a second downlink transmission beam in said sectors based on a received user-derived signal, the first downlink transmission beam being substantially uncorrelated with the second downlink transmission beam, the first downlink transmission beam being associated with a portion within a first sector of said spatial domain, the second downlink transmission beam being associated with a portion within a second sector;

diversity encoding a first signal in said first sector to produce a first diversity-encoded signal;

diversity encoding a second signal in said second sector to produce a second diversity-encoded signal;

sending the first diversity-encoded signal over the first downlink transmission beam; and

sending the second diversity-encoded signal over the second downlink transmission beam;

wherein the first downlink transmission beam is associated with a first uplink multipath from a plurality of uplink multipaths associated with a first user, the second downlink transmission beam is associated with a second uplink multipath from the plurality of uplink multipaths, the first uplink multipath and the second uplink multipath being no less optimal than the remaining uplink multipaths from the plurality of uplink multipaths.

2. The method of claim 1, wherein: the first signal and the second signal are diversity encoded so that an associated decoder error rate is less than a decoder error rate for one diversity-encoded signal.

3. The method of claim 1, wherein the first sector substantially corresponds to the second sector.

4. The method of claim 1, wherein the first sector differs from the second sector.

5. The method of claim 1, wherein: the received user-derived signal includes a first component and a second component, the first component of the received user-derived signal being received on a first antenna array, the second component of the received user-derived signal being received on a second antenna array, the first antenna array differs from the second antenna array.

6. The method of claim 1, wherein:the received user-derived signal includes a first component and a second component, the first component of the received user-derived signal being received on a first antenna array, the second component of the received user-derived signal being received on a second antenna array, the first antenna array substantially corresponds to the second antenna array.

7. The method of claim 1, wherein: the first downlink transmission beam is associated with a first polarization, the second downlink transmission beam is associated with a second polarization substantially orthogonal to the first polarization.

8. The method of claim 7, wherein: the first sector substantially corresponds to the second sector, and the portion within the first sector substantially corresponds to the portion within the second sector.

9. The method of claim 7, wherein: the portion within the first sector differs from the portion within the second sector.

10. The method of claim 1, wherein: the portion within the first sector overlaps, at least partially, with the portion within the second sector.

11. The method of claim 1, wherein: the first downlink transmission beam is sent from a first antenna array, and the second downlink transmission beam is sent from a second antenna array.

12. The method of claim 1, wherein: the first downlink transmission beam is sent during a first time period, and the second downlink transmission beam is sent during a second time period that overlaps, at least partially, with the first time period.

13. The method of claim 1, wherein: the first downlink transmission beam is associated with a first frequency range, the second downlink transmission beam is associated with a second frequency range at least a portion of which is different from the first frequency range.

15. The method claim 1, wherein the diversity encoding further includes: multiplexing a first pilot signal and an information signal to produce a first multiplexed signal; spreading and

scrambling the first multiplexed signal to produce a first spread/scrambled signal; and modifying the first spread/scrambled signal based on a first feedback signal.

16. The method of claim 15, wherein the diversity encoding further includes: multiplexing a second pilot signal and the information signal to produce a second multiplexed signal; spreading and scrambling the second multiplexed signal to produce a second spread/scrambled signal; and modifying the second spread/scrambled signal based on a second feedback signal.

17. The method of claim 1, wherein the determining includes: identifying a first multipath component and a second multipath component of the received user-derived signal for a first user, the first multipath component and the second multipath component being no less optimal than remaining multipath components of the received user-derived signal for the first user; identifying a first angular arrival range and a second angular arrival range based on the first multipath component and the second multipath component, respectively; and defining the first downlink transmission beam and the second downlink transmission beam based on the first angular arrival range and the second angular arrival range.

18. The method of claim 1, wherein the first signal and the second signal are diversity encoded based on the received user-derived signal.

19. The method of claim 1, wherein the first signal and the second signal are diversity encoded based on at least one characteristic of the received user-derived signal from the group of: a signal quality, a data rate, a signal strength, and a signal cross-correlation property.

20. The method of claim 1, wherein: the received user-derived signal includes a first component and a second component, the first component of the received user-derived signal being associated with its own multipath, the second component of the received user-derived signal being associated with its own multipath; the diversity encoding the first signal includes: determining a complex gain associated with the first diversity signal based on feedback information associated with the first component of the received user-derived signal; and the diversity encoding the second signal includes: determining a complex gain associated with the second diversity signal based on feedback information associated with the second component of the received user-derived signal.

21. The method of claim 1, wherein the first diversity-encoded signal is associated with its own diversity code, the second diversity-encoded signal is associated with its own diversity code that is separable from the diversity code associated with the first diversity-encoded signal.

22. A method for wireless communication for a first user, comprising the steps of:

determining a cell having a plurality of sectors;

receiving a first diversity-encoded signal from a first downlink transmission beam from one of said sectors; and

receiving a second diversity-encoded signal from a second downlink transmission beam from one of said sectors, the first downlink transmission beam being substantially uncorrelated with the second downlink transmission beam, the first downlink transmission beam being associated with a portion of a first sector of said plurality of sectors, the second downlink transmission beam being associated with a portion of a second sector of said plurality of sectors;

wherein the first downlink transmission beam is associated with a first uplink multipath from a plurality of uplink multipaths associated with the first user, the second downlink transmission beam is associated with a second uplink multipath from the plurality of uplink multipaths, the first uplink multipath and the second uplink multipath being no less optimal than the remaining uplink multipaths from the plurality of uplink multipaths.

23. The method of claim 22, further comprising:

sending a user-derived signal, the portion within the first sector being based on a first component of a received user-derived signal, the first component of the received user-derived signal being associated with a first multipath, and the portion within the second sector being based on a second component of the received user-derived signal, the second component of the received user-derived signal being associated with a second multipath.

24. The method of claim 22, wherein: the first downlink transmission beam is associated with a first polarization, the second downlink transmission beam is associated with a second polarization substantially orthogonal to the first polarization.

25. The method of claim 24, wherein: the first sector substantially corresponds to the second sector, and the portion within the first sector substantially corresponds to the portion within the second sector.

26. The method of claim 22, wherein: the portion within the first sector differs from the portion within the second sector.

27. The method of claim 22, wherein: the portion within the first sector overlaps, at least partially, with the portion within the second sector.

28. The method of claim 22, wherein: the first downlink transmission beam is sent from a first antenna array, and the second downlink transmission beam is sent from a second antenna array.

29. The method of claim 22, wherein: the first downlink transmission beam is sent during a first time period, and the second downlink transmission beam is sent during a second time period that overlaps, at least partially, with the first time period.

30. The method of claim 22, wherein: the first downlink transmission beam is associated with a first frequency range, the second downlink transmission beam is associated with a second frequency range at least a portion of which is different from the first frequency range.

32. The method of claim 22, wherein the first diversity-encoded signal and the second diversity-encoded signal have been diversity encoded based on a previous user-derived signal from the first user.

33. The method of claim 22, wherein the first diversity-encoded signal and the second diversity-encoded signal have been diversity encoded based on at least one characteristic of a previous user-derived signal from the group of: a signal quality, a data rate, a signal strength, and a signal cross-correlation property.

34. The method of claim 22, further comprising:

sending an uplink signal, a first component of the uplink signal being associated with its own multipath, a second component of the uplink signal being associated with its own multipath; the first diversity-encoded signal having its own complex gain based on feedback information associated with the first component of the uplink signal; and the second diversity-encoded signal having its own complex gain based on feedback information associated with the second component of the uplink signal.

35. The method of claim 22, wherein the first diversity-encoded signal is associated with its own diversity code, the second diversity-encoded signal is associated with its own diversity code that is separable from the diversity code associated with the first diversity-encoded signal.

36. An apparatus, comprising:

a searcher configured to identify a received user-derived signal;

a beam controller coupled to the searcher;

a first transmit beam switch coupled to the beam controller;

a second transmit beam switch coupled to the beam controller;

a diversity coder coupled to the first transmit beam switch and the second transmit beam switch, the diversity coder configured to send a first diversity encoded signal to the first transmit beam switch based on the received user-derived signal and to send a second diversity encoded signal to the second transmit beam switch based on the received user-derived signal; and

an antenna array coupled to the first transmit beam switch and the second transmit beam switch, the antenna array configured to define a first downlink transmission beam and a second downlink transmission beam, the first downlink transmission beam being associated with a portion within a first sector, the second downlink transmission beam being associated with a portion within a second sector, the first downlink transmission beam being substantially uncorrelated to the second downlink transmission beam, the first downlink transmission beam being associated with the first diversity-encoded signal, the second downlink transmission beam being associated with the second diversity-encoded signal;

wherein the first downlink transmission beam is associated with a first uplink multipath/ from a plurality of uplink multipaths associated with a first user, the second downlink transmission beam is associated with a second uplink multipath from the plurality of uplink multipaths, the first uplink multipath and the second uplink multipath being no less optimal than the remaining uplink multipaths from the plurality of uplink multipaths.

37. The apparatus of claim 36, wherein the first sector substantially corresponds to the second sector.

38. The apparatus of claim 36, wherein the first sector differs from the second sector.

39. The apparatus of claim 36, wherein the diversity coder includes: a first multiplexer configured to receive a first pilot signal and an information signal to produce a multiplexed signal; a first spread/scramble module coupled to the first multiplexer, the first spread/scramble module configured to receive the multiplexed signal associated with the first multiplexer, the first spread/scramble module configured to produce a spread/scrambled signal; and a first complex-gain multiplier coupled to the first spread/scramble module, the first complex-gain multiplier configured to receive the spread/scrambled signal associated with the first spread/scramble module and a first feedback signal.

40. The apparatus of claim 39, wherein the diversity coder further includes: a second multiplexer configured to receive a second pilot signal and the information signal to produce a multiplexed signal; a second spread/scramble module coupled to the second mutliplexer, the second spread/scramble module configured to receive the multiplexed signal associated with the second multiplexer, the second spread/scramble module configured to produce a spread/scrambled signal; and a second complex-gain multiplier coupled to the second spread/scramble module, the second complex-gain multiplier configured to receive the spread/scrambled signal associated with the second spread/scramble module and a second feedback signal.

41. The apparatus of claim 36, wherein the diversity coder further includes: a space-time coder configured to receive an information signal and configured to send a first space-time coded signal and a second space-time coded signal, the first space-time coded signal being orthogonal to the second space-time coded signal; a first spread/scramble module configured to receive the information signal and configured to send a spread/scrambled signal; and a second spread/scramble module configured to receive the space-time coded signal and configured to send a spread/scrambled signal.

42. The apparatus of claim 36, wherein: the searcher is configured to receive the received user-derived signal including a first component and a second component, the antenna array includes a first portion and a second portion, the first component of the received user-derived signal being received from a first user-derived reception beam on the first portion of the antenna array, the second component of the received user-derived signal being received from a second user-derived reception beam on the second portion of the antenna array, the first user-derived reception beam differs from the second user-derived reception beam, the first portion of the antenna array differs from the second portion of the antenna array.

43. The apparatus of claim 36 wherein: the searcher is configured to receive the received user-derived signal including a first component and a second component, the antenna array includes a first portion and a second portion, the first component of the received user-derived signal being received from a first user-derived reception beam on the first portion of the antenna array, the second component of the received user-derived signal being received from a second user-derived reception beam on the second portion of the antenna array, the first user-derived reception beam substantially corresponds to the second user-derived reception beam, the first portion of the antenna array substantially corresponds to the second portion of the antenna array.

44. The apparatus of claim 36, wherein: the first downlink transmission beam is associated with a first polarization, the second downlink transmission beam is associated with a second polarization substantially orthogonal to the first polarization.

45. The apparatus of claim 44, wherein: the first sector substantially corresponds to the second sector, and the portion within the first sector substantially corresponds to the portion within the second sector.

46. The apparatus of claim 36, wherein: the portion within the sector associated with the first downlink transmission beam differs from the portion within the sector associated with second downlink transmission beam.

47. The apparatus of claim 36, wherein: the portion within the sector associated with the first downlink transmission beam overlaps, at least partially, with the portion within the sector associated with second downlink transmission beam.

48. The apparatus of claim 36, wherein: the antenna array includes a first portion and a second portion, the first downlink transmission beam is sent from the first portion of the antenna array, and the second downlink transmission beam is sent from the second portion of the antenna array.

49. The apparatus of claim 36, wherein: the first downlink transmission beam is sent during a first time period, and the second downlink transmission beam is sent during a second time period that overlaps, at least partially, with the first time period

50. The apparatus of claim 36, wherein: the first downlink transmission beam is associated with a first frequency range, the second downlink transmission beam is associated with a second frequency range at least a portion of which is different from the first frequency range.

52. The apparatus of claim 36,wherein: the searcher is configured to identify a first multipath component and a second multipath component of the received user-derived signal for a first user, the first multipath component and the second multipath component being no less optimal than remaining multipath components of the received user-derived signal for the first user; and the beam controller being configured to define the first downlink transmission beam and the second downlink transmission beam based on the first angular arrival range and the second angular arrival range.

53. The apparatus of claim 36, wherein the diversity coder is configured to encode a first signal and a second signal based on a received user-derived signal to produce the first diversity-encoded signal and the second diversity-encoded signal.

54. The apparatus of claim 36, wherein the diversity coder is configured to encode a first signal and a second signal based on at least one characteristic of the received user-derived signal from the group of: a signal quality, a data rate, a signal strength and a signal cross-correlation property, to produce the first diversity-encoded signal and the second diversity-encoded signal.

55. The apparatus of claim 36, wherein: the searcher is configured to receive the received user-derived signal, the received user-derived signal includes a first component and a second component, the first component of the received user-derived signal is associated with its own multipath, the second component of the received user-derived signal being associated with its own multipath; the diversity coder is configured to:determine a complex gain associated with the first diversity signal based on feedback information associated with the first component of the received user-derived signal; and determine a complex gain associated with the second diversity signal based on feedback information associated with the second component of the received user derived signal.

56. The apparatus of claim 36, wherein the first diversity-encoded signal is associated with its own diversity code, the second diversity-encoded signal is associated with its own diversity code that is separable from the diversity code ssociated with the first diversity encoded signal.

EVIDENCE APPENDIX

Not applicable

RELATED PROCEEDINGS APPENDIX

Not applicable